A ½ inch bore, 1 inch stroke, Model Beam Engine

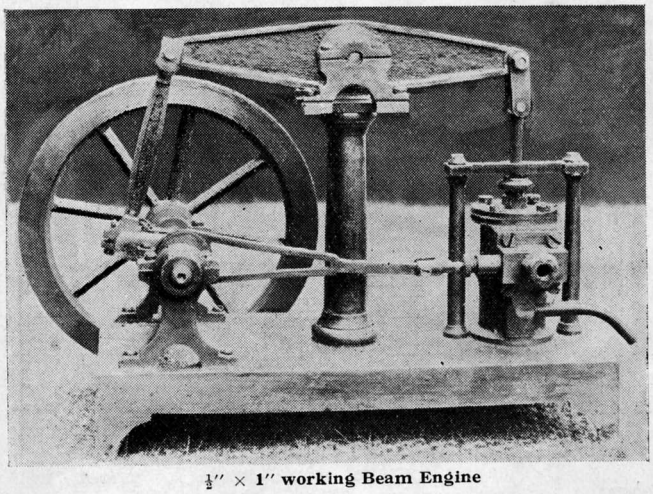
Described by W. W. MASON

THE little model engine about to be described was kindly lent to me for this purpose by Mr. S. W. Simpson, to whom many members of the Society of Model and Experimental Engineers are indebted for some very delightful days spent at his house.

The model was made probably about the same date as the "Planet" type double-action oscillating cylinder locomotive described by Mr. Gentry in Vol. 60 of the MODEL ENGINEER, and is therefore about fifty years old. It is also about as inaccurate and lacking in details as the locomotive; nevertheless it makes quite a pretty little working model.

This engine has some rather unusual features: (A) the absence of the usual parallel motion; (B) the main bearings for the beam; (C) the eccentric rod and strap.

Taking these three features in the order given: (A) The arrangement substituted for the usual parallel motion is, of course, done to simplify construction, and consists of a guide for the piston rod placed just above the gland, and by connecting the rod to the beam end by means of a pair of flat links hinged on the crosshead pins so that they can accommodate themselves to the arc described by the beam end during its period of vibration. The



½" × 1" working Beam Engine

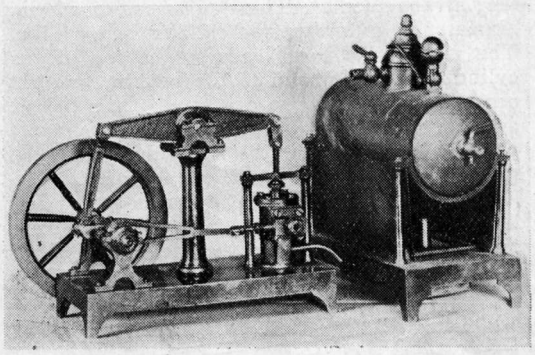
photograph shows this piston rod guide supported by two turned brass columns screwed into the bedplate.

Beam Trunnions.

(B) The two trunnions, their "caps," feet, and the square plate resting on the column top, are all cast in one piece, there being no removable caps. The bearings are simply drilled through, and a steel pin 5/32 in. driven in for the beam to swing upon.

Eccentric Rod.

(C) The eccentric strap and skeleton rod are made in one piece from sheet brass, about No. 14 gauge. From an examination of the sketch (Fig. 1) it will be seen that the strap is split in two places on the horizontal centre line, and it can therefore be sprung open sufficiently to allow its being slipped over into the eccentric sheaf groove and then secured by a screw, No. 8 B.A. in this case. The valve is worked on the slip-eccentric principle,



The Beam Engine and simple Pot-Boiler

the sheaf being driven by a segmental-headed pin driven into the crankshaft, so the engine will work in either direction.

Main Bearings.

The main bearings for the crankshaft are split, and caps are held down by screws in the usual way.

The Bed Plate.

The bedplate, or base, consists of a brass casting 5⅜ in. in length by 2 5/16 in. in width and ⅞ in. in height. Its thickness is 1/16 in., except at the corners, which are left thicker for strength. The flywheel is 3 7/16 in. diameter and ¼ in. in width on the rim.

The model (engine and boiler) is constructed entirely of brass, with the exceptions of the crankshaft, beam pin, crosshead and valve spindle. All screws were originally of brass, but some have been replaced by the present owner with steel ones.

Cylinder.

The cylinder is ½ in. bore by 1 in. stroke; made from a casting, but is now fitted with a liner of hard drawn brass tubing. I fancy the reason for this is that at some time a previous owner had the misfortune to twist off one of the screws fixing the steam-chest cover, and in drilling it out the drill penetrated the cylinder wall, which is very thin. The piston, 3/16 in. in length, is of the usual old type with a ⅛ in. groove packed with cotton, and is screwed and soldered to the ⅛ in. piston rod. The upper end of piston

rod is turned down, screwed No. 6 B.A., to pass through crosshead, and secured by a nut.

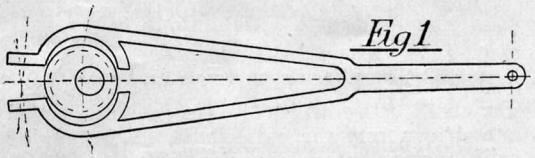
Crosshead.

The crosshead is a piece of ¼ in. round M.S. 5/16 in. in length turned down to ⅛ in. each end, forming two spigots, upon which the lower ends of the two brass links work, thus connecting the crosshead to the beam. The links are made from 16 gauge brass strip 3/16 in. in width and ½ in. centres.

Steam Ports.

To return to the cylinder, it will be noticed that as the valve works at right angles to the piston rod, the steam ports are not in the usual position. The sketch (Fig. 2) shows the arrangement. The ports are 1/16 in. diameter holes, steam and exhaust being alike. The right hand port leads to the top of the cylinder, the left hand to the bottom, and the centre (exhaust) is also drilled up from below, and then plugged up to where the exhaust passage passes out at the side; this is tapped to take a piece of 5/32 in. copper pipe.

The slide valve is of hard drawn brass, and has 5/32 in. travel and a full 1/32 in. steam lap, so ports are opened to steam for about half their width only.



Split eccentric strap sprung open to pass over the sheave

General Dimensions.

Height of beam centre from bedplate = 3 1/16 in.
Length of beam between centres = 3 11/16 in.
Width across beam trunnions = 1⅛ in.
Width of beam = 5/32 in.
Length of crankshaft = 3 in.
Diameter of crankshaft = ¼ in.
Crankpin, length 3/16 in., diameter = 3/16 in .
Length of connecting rod (centres) = 2⅛ in.
Height of crankshaft bearings from bedplate = 1 in.
Width of bearings = 3/16 in.
Diameter of valve spindle = 3/32 in.

The connecting rod is a casting, flat and with the flutes cast in, and has a forked top-end. Big-end split, with cap.

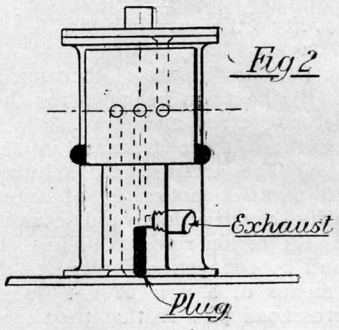
The Boiler

The boiler consists of a piece of brass tubing 2 in. in diameter and of about No. 20 gauge, having the domed ends spun over and soldered in. The overall length is 5 in. The present owner has augmented the heating surface by fitting ten brass screws in the boiler barrel on the underside, and he tells me that its steaming properties have been improved immensely thereby. Mr. Crebbin tried out this dodge some years ago on a locomotive boiler and described the results in the MODEL ENGINEER.

The boiler rests upon two brass slings supported by four turned brass columns which are screwed into a base similar to that of the engine, but having an opening cut therein 3½ in. by 1½ in., into which the spirit reservoir drops.

This reservoir is made of tinned steel soldered up, and has a brass edging all round it which rests upon the brass base, thus the lamp is suspended and does not rest on the table. The lid is flat and is provided with three wick tubes of brass, ¼ in. in diameter; they stand up ⅝ in. from the lid, but do not project below it more than enough to hold a fillet of solder.

The usual type of safety valve is fitted in the top of the "dome," and a plug steam-cock in side of same. Working pressure is, I expect, about 15 lb. per sq. in. The engine works well with the aid of a cycle pump, so should go well by steam.



Sketch showing arrangement of steam-ports

In my opinion this little model could be improved considerably by making the following alterations. The beam should be raised by at least one inch by means of a longer column; at the same time the main bearing standards should be lowered by half an inch. These alterations would permit of a longer connecting rod being used and also longer links between piston rod and beam. The piston rod guide could be raised, say, half an inch, and thus be more effective in steadying the piston rod when at the top of its stroke.

The beam might be lengthened with advantage without altering the position of the cylinder or crankshaft. By having the beam of such a length that the connecting links assume a vertical position when piston is at the bottom of the cylinder, less side strain would be put on the piston rod and gland, and therefore less friction set up. A larger and heavier flywheel would make for smooth and slow working; this would entail lengthening the feet of the base to keep flywheel clear of the ground level, unless the wheel worked in a "pit."

The base could be made up as a tank to hold water, and a pump fitted therein worked from the beam to pump the feed water into the boiler. This would form a realistic and useful addition. The exhaust steam might be discharged into the tank, thus partly condensing and warming the feed water.

A model constructed on these lines would prove an interesting job, and would also look well when working. It would be worthy of a better type of boiler than that described.